MARVIKEN NUCLEAR POWER STATION

DESIGNER & CONTRACTOR AB Atomenergi, the Swedish State Power Board, and ASEA

OWNER & OPERATOR The Swedish State Power Board

LOCATION On the Baltic Sea about 40 km east of Norrköping

TYPE Boiling Heavy Water direct cycle reactor with possibility of installing nuclear superheating

	Saturated steam operation	Superheated steam operation
CONSTRUCTION SCHEDULE		
Site work started	Nov. 18th, 1963	
Reactor critical	End 1969	
Full power operation	Early 1970	
CAPACITY		
Gross generation	139 MW	203 MW
Net electrical output	132 MW	196 MW
Overall station net efficiency	29·4%	34·4%
REACTOR CORE		
Reactor output	474 MW(th)	591 MW(th)
Core diameter	4·3 m	
Core height	4·42 m	
Number of boiler fuel assemblies	147	
Number of superheater fuel assys.	32	
Lattice square pitch	250 mm	
FUEL		
Fuel material	UO_2	
Total quantity of UO_2	33·6 ton	
Discharge irradiation	13 000 MWd/t	

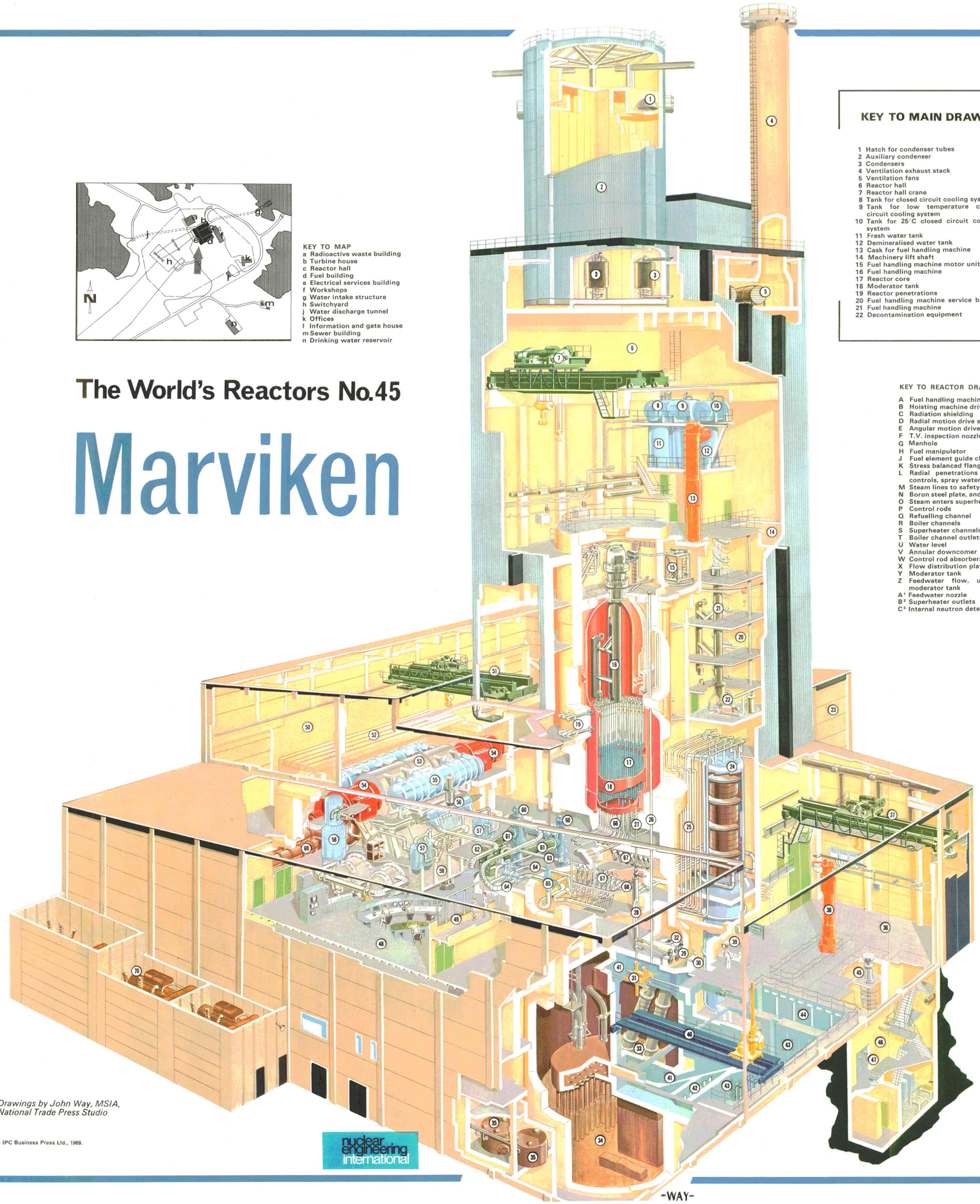
	Boiler element	Superheater element
Number of rods/element	36	45
Pellet diameter	12·5 mm	13·0 mm
Can material	Zr-2	Incoloy
Can thickness	0·6 mm	0·4 mm
Enrichment	1·35%	1·73%
Number of fuel channels	147	32
Channel inner diameter	160 mm	160 mm
Channel wall thickness	1·25 mm	3·85 mm
Channel material	Zr-2	Zr-2

CONTROL	
Number of safety rods	24
Number of regulating rods	16
Absorber material	70% Ag, 30% Cd
Rod type	Hydraulic piston type
Max. rod diameter	167 mm
Rod length	5 500 mm
Stroke length	4 300 mm
THERMAL DATA	
Steam flow	215 kg/sec
Steam pressure	49·5 bar
Steam temperature:	
Saturated steam operation	263°C
Superheated steam operation	475°C
Feed water temperature	110°C
Max. boiler fuel temperature:	
Saturated steam operation	1 800°C
Superheated steam operation	1 750°C
Max. superheater fuel temperature	2 200°C
REACTOR PRESSURE VESSEL	
Inside diameter	5·22 m
Inside height	21·52 m
Average wall thickness	76 mm
Thickness of SS cladding	5 mm
Design pressure	57·5 bar
Design temperature	272°C
Material	A 332 B (Degerfors DE-631A)
Weight (incl. vessel head)	255 ton
TURBINE	
Type	STAL-LAVAL radial flow contra-rotation
Speed	3 000 rev/min
Boiler steam at turbine inlet:	
Pressure	44 bar
Temperature	259°C
Superheated steam at turbine inlet:	
Pressure	41 bar
Temperature	472°C
CONDENSER	
Condenser pressure:	
Sat. steam operation	0·0306 bar
Superh. steam operation	0·0373 bar
Cooling water temperature	7°C
Cooling water flow	6 700 kg/sec
Cooling area	8 800 m²
Number of tubes	10 500
Tube length	12 m
Tube dimension	$\frac{7}{8}$ in (22 mm)
Tube material	Alum. brass
GENERATOR	
Design	Two 3-phase synchronous
Speed	3 000 rev/min
Rating	2×111,5 MVA
Terminal voltage	10·5 kV
Power factor	0·9
Frequency	50 Hz
Coolant	H_2
Total weight each	108 ton
MAIN TRANSFORMER	
Rated power	220 MVA
High voltage rating	147 kV
Low voltage (2 windings)	10·5 kV

KEY TO MAP
a Radioactive waste building
b Turbine house
c Reactor hall
d Fuel building
e Electrical services building
f Workshops
g Water intake structure
h Switchyard
j Water discharge tunnel
k Offices
l Information and gate house
m Sewer building
n Drinking water reservoir

The World's Reactors No.45

Marviken

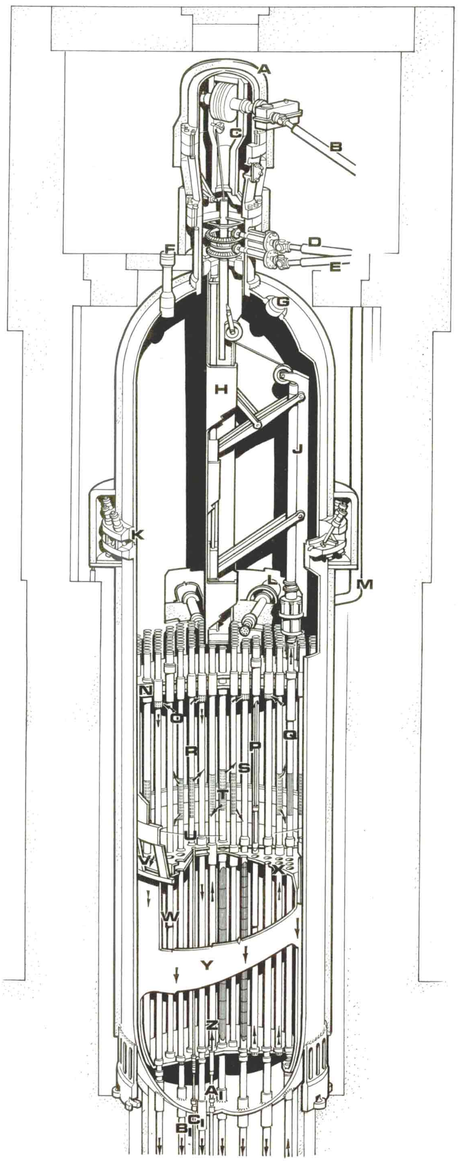


KEY TO MAIN DRAWING

1 Hatch for condenser tubes
2 Auxiliary condenser
3 Condensers
4 Ventilation exhaust stack
5 Ventilation fans
6 Reactor hall
7 Reactor hall crane
8 Tank for closed circuit cooling system
9 Tank for low temperature closed circuit cooling system
10 Tank for 25°C closed circuit cooling system
11 Fresh water tank
12 Demineralised water tank
13 Cask for fuel handling machine
14 Machinery lift shaft
15 Fuel handling machine motor unit
16 Fuel handling machine
17 Reactor core
18 Moderator tank
19 Reactor penetrations
20 Fuel handling machine service bay
21 Fuel handling machine
22 Decontamination equipment
23 Radioactive service area
24 Steam dump tank
25 Steam pipe lines to steam dump tank
26 Chute for shroud tubes
27 Fuel charging channel
28 Transfer lock
29 Controls for fuel charging valves
30 Emergency access to controls of fuel charging valves
31 Transport channel machine
32 Lute apertures
33 4 lutes
34 Wet well
35 Waste-water tanks
36 Fuel handling building
37 Fuel handling crane
38 Transfer cask
39 Switching equipment for transport channel machine
40 Pond bridge
41 Transport channel
42 Basin for mechanical operations
43 New fuel pond (also for spent fuel after long decay time)
44 Spent fuel pond (short decay time fuel)
45 Control rod service rig
46 Control rod service room
47 Control rod service manipulators
48 Control room
49 Control room viewing gallery
50 Turbine hall
51 Turbine hall crane
52 Turbine shield
53 Turbine
54 Generators
55 Moisture separator
56 Governor valve
57 H.P. heaters
58 Boiler feed water tank
59 Condenser
60 Condenser cooling water pumps
61 Condenser cooling water
62 Feed water pumps
63 Return pipe to reactor
64 Steam pipes reactor—turbine
65 Main steam valve
66 Superheater pipes from reactor to valves
67 Steam valves
68 Blow off valves to steam dump tank
69 Electricity conduits from generators
70 Transformers

KEY TO REACTOR DRAWING

A Fuel handling machine cupola
B Hoisting machine drive shaft
C Radiation shielding
D Radial motion drive shaft
E Angular motion drive shaft
F T.V. inspection nozzle
G Manhole
H Fuel manipulator
J Fuel element guide chute
K Stress balanced flange
L Radial penetrations for hydraulic controls, spray water, and services
M Steam lines to safety valves
N Boron steel plate, and internal shielding
O Steam enters superheater channels
P Control rods
Q Refuelling channel
R Boiler channels
S Superheater channels
T Boiler channel outlets
U Water level
V Annular downcomer
W Control rod absorbers
X Flow distribution plate
Y Moderator tank
Z Feedwater flow, upwards through moderator tank
A¹ Feedwater nozzle
B¹ Superheater outlets
C¹ Internal neutron detectors



Drawings by John Way, MSIA, National Trade Press Studio

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